

Pipeline & Utilities Construction

OCTOBER 1991



International Pipeline Report

- World's Deepest Directional Drill
- Coal Slurry Line in Andes
- Papua New Guinea Oil Line
- International Pipeline Forecast

Pipeline & Utilities Construction

October 1991 Volume 46 Number 10A



On the cover: Track-mounted drills set blastholes to lay Chevron's 165-mile oil line in the highlands of New Guinea.



Page 24: Techint tackles the Andes Mountains to lay a coal slurry line from Los Broncos Mine to Santiago, Chile.



Page 36: The world's deepest shore approach was drilled at Texada Island as part of Pacific Coast Energy's Vancouver Island Natural Gas pipeline.

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Kubota

Pipeline & Utilities Construction

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INTERNATIONAL PIPELINE FORECAST

Final figures for our annual International Pipeline Forecast paint a bright picture for pipeline expansion in many parts of the world.

The totals show 22,188 miles planned for the 1991-92 period at a cost of \$14.7 billion.

INTERNATIONAL PIPELINE FORECAST 1991-92

	Mileage	Est. Cost (Billions)
Gas Pipelines	14,030	\$17.167
Crude Oil Lines	2,933	1763
Products Pipelines	5,225	.848
World Total	22,188	\$21.778
Future Proposed Pipelines		
Gas Pipelines	29,142	4.622
Crude Oil Lines	4,589	3.336
Products Pipelines	1,876	.510
World Total	35,607	8.468

Crude Oil Pipelines

Sonatrach

Algeria
239 miles, 34 inches
Cost: \$200,000,000
Houd el Hanra to Skikda

Petrobras

Brazil
22 miles, oil line
Cost: \$260,000,000
Sao Paulo to Santos

China National Oil Corp.

China
180 miles, 20 inches
Cost: \$80,000,000
Zhongyuan field to Luoyang.
Henan refinery

Cuban government

Cuba
116 miles, 20 inches
Matanzas terminal to refinery at Cienfuegos

Conoco Ecuador, Ltd.

Ecuador
Dual 100 mile lines
Cost: \$200,000,000
Oriente region

Kenya Pipeline Co., Ltd.

Kenya
225 miles, 8 inches
Cost: \$100,000,000
Extend Mombasa-Nairobi line to Uganda border

Korea Ministry of Energy and Resources

Korea
540 miles, large diameter
Cost: \$450,000,000
Western Pipeline: Yeosu to Seoul
Eastern Pipeline: Onsan to Seoul

Societe Cherifienne des Patroles

Morocco
115 miles, 14 inches
Cost: \$8,000,000
Port of Mohammedia to Side Kacem refinery

Chevron Corp.

New Guinea
163 miles
Cost: \$125,000,000
Kutubu to terminal at Gulf of Papua

National Nigerian Petroleum Corp.

Nigeria
308 miles, 12, 16 inches
Cost: \$250,000,000
Port Harcourt to River Niger

Shell Petroleum Development Co.

Nigeria
7 miles, 8 inches
43 miles, 20 to 24 inches, Opokushi

to Forcados
6 miles, 8 inches, flow station to Ogara
6 miles, 8 inches, to Kanbo manifold
Cost: \$5,000,000

Chinese Petroleum Corp.

Taiwan
40 miles, 12 to 20 inches crude and products line to oil terminal
Cost: \$5,000,000

Botas

Turkey
570 miles, large diameter
Looping of oil line from Iraq to Turkey

Products Pipe Lines

Ecopetrol

Colombia
119 miles, 6, 12 inches
Cost: \$30,000,000
Three lines: Medellin to Rionegro, Facatativá to Villavicencio, Sebastopol to Medellin

Ste. du Pipeline Méditerranée-Rhône

France
94 miles, 12 inches
Cost: \$25,000,000
La Mede to Puget-sur-Argens

Petromin

Indonesia
650 miles, 10 inches
Cost: \$75,000,000
Trans Java network

National Iranian Oil Co.

Iran
1,139.6 miles, 12 inches
Cost: \$90,000,000
Arak to Malayer and Mahanabad

Kenya Pipelines Co. Ltd.

Kenya
355 miles, 6 to 8 inches
Cost: \$40,000,000
Nairobi to Kisumu/Eldoret

Korea Petroleum Development Corp.

Korea
541 miles products line network
Cost: \$25,000,000
Yosu and Onsan to Seoul

Nigerian National Petroleum Corp.

Nigeria
33 miles, 16 inches
Bonny terminal to Port Harcourt
309 miles, 12, 16 inches
Port Harcourt, Enugu, Auchi to Benin City
Cost: \$140,000,000

Petroleos Del Peru

Peru
52 miles, 4 to 6 inches
Aguyayla to Pucallpa-Campo 30 miles, 3 inches
Aguyayla to Campo Verde
Cost: \$3,000,000

Campsa

Spain
13 miles, 8 inches
Almódovar to Merida
60 miles, 10 inches
Alicante to Cartagena
90 miles, 10 inches
La Coruña to Vigo
Cost: \$20,000,000

Corpoven SA

Venezuela
373 miles, medium diameter
Cost: \$100,000,000
Puerto la Cruz refinery to Maturín, San Tomé, Ciudad Bolívar, Puerto Ordaz, Puerto Ayacucho

Maraven SA

Venezuela
258 miles, 12 inches
Cost: \$75,000,000
San Lorenzo, Lake Maracaibo, to El Vigía and Tachira

Lonrho PLC

Zimbabwe
135 miles, 10 inches
Cost: \$30,000,000
Feruka to Harare

Natural Gas Pipelines

Abu Dhabi National Oil Co.

Abu Dhabi
93 miles, 28 inches
Cost: \$50,000,000
Maqta to Al Ain

Algeria, Spain, Morocco

1,265 miles, 20 to 24 inches
Cost: \$1,300,000,000
Algeria to Morocco under Mediterranean Straits, starting at Hassi R'Mel field in Algeria, ending at Seville, Spain, 300 miles.
Hassi R'Mel field to Morocco, across Straits of Gibraltar to Seville

Sonatrach

Algeria
300 miles, 24 inches
Cost: \$200,000,000
Hassi R'Mel field to Moroccan border

Auckland Gas Co.

Australia
40 miles, 1 to 6 inches
Cost: \$5,000,000
Auckland area

Doral Resources

Australia
50 miles, medium diameter
Cost: \$35,000,000
Onslow to Damp, Bunbury line

Gas & Fuel Corp.

Australia
16 mile gas line and distribution lines in Singapore

Gas & Fuel Corp. of Victoria

Australia
80 miles, various sizes
Cost: \$20,000,000
Kathook to Portland, Victoria
209 miles, various sizes
Cost: \$16,000,000
Melbourne-Victoria

Magellan Petroleum Corp.

Australia
375 miles
Cost: \$150,000,000
Amadeus-Darwin line to Gove

Pipeline Authority of S. Australia

Australia
82 miles, 12 inches
Cost: \$40,000,000
Wagga Wagga to Albury, New South Wales

Distrigaz

Belgium
65 miles, 16 inches
Cost: \$5,000,000
Zeebrugge to Blaregnies

Energiebedrijven Schiedeland

Belgium
57 miles, 14 to 40 inches
Cost: \$40,000,000
Replacement Antwerp area

YPFB

Bolivia
332 miles, 24 inches
Cost: \$250,000,000
Santa Cruz to Brazilian border

Carbocol

Colombia
310 miles, 24 inches
Cost: \$800,000,000
San Cristóbal, Venezuela to Bogotá, Colombia

Ecopetrol

Colombia
58 miles, 20 inches
Cost: \$30,000,000
Dibulla to Ballenas

Promigas

Colombia
621 miles, 20 to 24 inches
373 miles, 20 inches
248 miles, 24 inches
Cost: \$250,000,000
Dibulla to Ballenas

INTERNATIONAL FORECAST

Dansk Olie Og Naturgas

Denmark
67 miles: 10, 12, and 30 inch lines
Cost: \$5,000,000

Dubai Natural Gas Co

Dubai
200 miles: large diameter
Cost: \$150,000,000
Qatar's North field to Jebel Ali, Dubai

Bapetco

Egypt
74 miles: 16 inches
55 miles: 16 inch loop from

BED 2 to Aminriyah
19 miles: BED 2 to BED 3
Cost: \$60,000,000

Khalda Petroleum Co.

Egypt
59 miles: 10 inches
Cost: \$15,000,000
Salam to Mersa Matruh

Gaz de France

France
44 miles: 24 inches
Cost: \$30,000,000
Salam to Lacq

BEB

Germany
100 miles: medium diameter
Cost: \$50,000,000
Achim to Salzweidel

EVG

Germany
106 miles: 32 to 40 inches
Cost: \$80,000,000
Vitzroda to Gera

Erdgasversorgungsgesellschaft

Germany
200 miles
Cost: \$150,000,000

Vitzroda to Niederhohndorf, Saxony

Kombinat Gasanlagen

Germany
155 miles: medium diameter
Cost: \$75,000,000
Philippsthal to Sayda

Midas GmbH

Germany
Joint venture Wintershall/OMV
348 miles: 32 inches
Cost: \$200,000,000
Rysum to Ludwigshafen

Ruhrgas AG

Germany
153 miles: 48 inches
Werne to Schluchtern
49 miles: 40 inches
Lauterbach to Vitzroda
15.5 miles: 24 inches
Vinnhorst to Ahlen
Cost: \$150,000,000

Statoil

Germany
44 miles: 42 inches
Cost: \$100,000,000
Emden to Etzel

Wintershall AG

Germany
350 miles: large diameter
Cost: \$300,000,000
Rysum to Ludwigshafen

Hungarian Oil & Gas Trust

Hungary
22 miles: 31 inches
Cost: \$20,000,000
Piliss to Dorog

Gujarat Gas Co., Ltd.

India
330 miles: medium diameter
Cost: \$150,000,000
Gas network in Gujarat state

Oil and Gas Commission

India
175 miles: medium diameter
Cost: \$150,000,000
East and West Godavan districts of Andhra Pradesh
95 miles: medium diameter
Cost: \$75,000,000
Southern loop, Western Offshore Integrated Development Project

Bord Gais Eireann

Ireland
45 miles: 30 to 36 inches
Cost: \$2,000,000
Easington to Pauli
120 miles offshore line: 50 miles onshore line
Cost: \$360,000,000
Gas line from Moffat, Scotland, to Dublin, Ireland

Agip

Italy
84 miles
Cost: \$20,000,000
Libya - Bu Attifel field to gas treatment plant

Petronas

Malaysia
109 miles: 30 inches
Cost: \$100,000,000
Labis to Singapore; Pientong to Pasir Gudang
197 miles: 5, 8, 16, and 26 inches
Cost: \$365,000,000
Several fields offshore Sarawak

Ministry of Energy

New Zealand
140 miles: 14 to 20 inches
Cost: \$70,000,000
Huntly to Marsden power stations

Statoil

Norway
524 miles: 30 to 40 inches: Zeepipe line
Sleipner to Zeebrugge, Belgium
80 miles: 36 inches: Zeepipe Troll to Heimdal
95 miles: 40 inches: Zeepipe Troll to Sleipner
150 miles: 20 inches: Sleipner to Karsto
Cost: \$1,500,000,000

Petroleum Development Co.

Oman
68 miles: medium diameter
Cost: \$30,000,000
Lekhwair field to domestic gas grid

Pipeline Construction

We design and construct for you pipelines and products-distribution-systems for transport of gas, liquids and slurry. • in all diameters • including construction of all underground facilities and utilities,

blasting, tunnelling, river crossings • with all civil and special constructions • with tank farms and pumping-, pressure reducing- and boosting stations • with treatment-, metering- and filling systems.

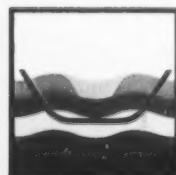
Pipeline-Service - Any Size - Any Length - Anywhere

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- Leak detection.
- Dewatering, drying (methanol, air, vacuum, or nitrogen) and conservation of pipelines.
- UltraScan ultrasonic pigs for internal and external corrosion and lamination surveys.
- Cleaning pipelines with various special cleaning pigs.
- Pigging with viscous gel.
- Caliper surveys - locating dents and buckles.
- Corrosion and crack detection.

Worldwide

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Federal Republic of Germany



Crossings



Pipeline Service

Sui Gas Transmission Co.

Pakistan
182 miles, 20 inches
Cost: \$50,000,000
Sui to Karachi

Petroleos del Peru

Peru
364 miles, 26 inches
64 miles, 8 inches
Cost: \$50,000,000
Camisea-Cuzco to Callao-Lima

Portuguese government

Portugal
200 miles
Cost: \$800,000,000
Lisbon to Braga near Spanish border plus distribution systems - five year program

Enagas

Spain
300 miles, 26 inches
Cost: \$481,000,000
Seville to Madrid
200 miles, 12 to 24 inches
Cost: \$60,000,000
Redes Navarra area

Stoseb

Sweden
150 miles gas grid around Stockholm
Cost: \$30,000,000

Al-Furat Petroleum

Syria
335 miles, 8 to 18 inches
275 miles, 18 inches. Omar field to Damascus
60 miles, 8 to 12 inch lines to Thayyem, Tishreen, Adra
Cost: \$150,000,000

Chinese Petroleum Corp.

Taiwan
190 miles, 8 to 24 inch loop lines
Cost: \$50,000,000
Yungang to Tunghsiao

Petroleum Authority of Thailand

Thailand
45 miles, 16 to 18 inches
Cost: \$15,000,000
Gas main grid around Bangkok
Second line from southern Thailand to Bangkok
425 miles offshore, 500 miles from Khamom to Bangkok
Cost: \$600,000,000
100.6 miles, 24 inches. Erawan to Khamom district
106.3 miles, 32 inches. Erawan field line
121 miles, 32 inches
Texas Pacific field to Erawan
Cost: \$150,000,000

Botas

Turkey
400 miles up to 12 inches
Bursa city distribution system
510 miles, large diameter, 310 miles Bursa to Izmir and 210 miles Izmit to Karabuk
Cost: \$150,000,000

Amoco Exploration Co.

UK
254 miles, 36 inches
Cost: \$225,000,000
Central Area Transmission system: Everest and Lomon offshore fields to Teesside

Gas Transmission U.K. Ltd.

UK
180 miles, 30 to 36 inches
Cost: \$150,000,000
Bacton to Thames Estuary, east of London

Kinetica, Ltd. (Conoco PowerGen)

UK
175 miles, 36 inches
Cost: \$30,000,000
Lincolnshire coast to power stations

Scottish Area Gas Evacuation System (Sage)

UK
150 miles, 24 inch
Cost: \$475,000,000
Mobil North Sea Marathon Oil, Beryl North Sea field to St. Fergus

Shell United Kingdom Exploration & Production

UK
118 miles, 24 inches
Cost: \$75,000,000
Bacton to Shell Haven refinery on the Thames Estuary

Total Oil Marine

UK
110 miles, 22 inches
Cost: \$75,000,000
Caister field, UK North Sea, to Killingholme

Petroleos de Venezuela

Venezuela
28 miles, 16 inches
Cost: \$5,000,000
Offshore Margarita Basin fields to Mapipe Bay

Energoinvest with INA

Yugoslavia
80 mile line connecting eastern and western gas networks
Cost: \$5,000,000

Yugoslavian government

Yugoslavia
650 miles, small to medium diameter, 160 miles main line, 415 miles main and distribution lines, 75 miles urban mains
Cost: \$100,000,000

FUTURE PROJECTS

Crude Oil Pipelines

Broome Oil Pipeline Systems

Australia
300 miles, medium diameter
Cost: \$85,000,000
Canning basin area of Western Australia

National Iranian Oil Co.

Iran
600 miles, large diameter
Cost: \$500,000,000
Gachsaran field, near Persian Gulf to Port of Jask, Gulf of Oman

Shell Pipeline Petroleum Dev.

Nigeria
43 miles, 20 to 24 inches
Cost: \$50,000,000
Opukushi to Forcados terminal

Tazama Pipeline Ltd.

Tanzania
670 miles, 8 to 24 inches
Cost: \$201,000,000
Tanzania to Zambia

Botas

Turkey
2,976 miles, large diameter
Cost: \$2,500,000,000
Agajay to Iskenderun Gulf (between Iran and Turkey)

Products Pipelines

Sonatrach

Algeria
500 miles, medium diameter
Cost: \$125,000,000
Southeast Algerian fields to Hassi Messaoud

Oil India Ltd.

India
826 miles, medium diameter
Cost: \$200,000,000
Khandia to Bhatinda

Laos government

Laos
260 miles, medium diameter
Cost: \$85,000,000
Vinh, Vietnam to Vientiane, Laos

Statoil

Norway
140 miles, 20 inches
Cost: \$420,000,000
Condensate line from Sleipner field to Karstoe

British Petroleum

UK
150 miles, 24 inches
Cost: \$100,000,000
Bruce field to Forties field, UK North Sea

Natural Gas Pipelines

Argentine government

Argentina
600 miles, 10 to 24 inches
Cost: \$300,000,000
Campo Duran to Chaco, Argentina

Gas del Estado

Argentina
350 miles, 18 inches
Santa Fe, Argentina, to Morvideau, Uruguay
775 miles, 30 inches
Salta Province, Argentina, to Rio Grande de Sul state, Brazil
Cost: \$300,000,000

Department of Resources & Energy

Australia
3,000 miles, large diameter
Cost: \$3,000,000,000
Transcontinental Australia pipeline

Mt. Isa Mines Ltd.

Australia
500 miles, medium diameter
Cost: \$75,000,000
Cooper Basin fields to Mt. Isa

Petrobangla

Bangladesh
159 miles, 6, 16, and 20 inches
Cost: \$48,800,000
Kailashila field to grid in Ashuganj

Distrigaz

Belgium
91 miles, various inches
Zeebrugge to Blaregnies

Petrobras

Brazil
1,175 miles, large diameter
Cost: \$400,000,000
1,050 miles from Urucu region to Carajas, 125 mile spur to Manaus. Extensions to Belem and Sao Luis could add 700 miles

Y.P.F.B. Petrobras

Brazil
1,010 miles, 24 inches
Cost: \$400,000,000
Brazil/Bolivia border to Sao Paulo, Brazil

TransAsean Consortium

Brunei-Indonesia-Malaysia-Philippines-Thailand
5,000 miles, large diameter
Cost: \$3,000,000,000
Fields offshore Thailand through Malaysia, Indonesia, and Brunei to the Philippines

China National Offshore Oil Corp.

China
60 miles, 30 inches
Cost: \$10,000,000
Yacheng field, South China Sea to Hainan Island

China Offshore Gas Utilization Corp.

China
680 miles, 24 inches
Cost: \$300,000,000
Hainan Island to Guangzhou

Dubai Natural Gas Co.

Dubai
200 miles, large diameter
Cost: \$150,000,000
Qatar's North field to Jebel Ali, Dubai

Ministry of Trade and Industry

Finland
250 miles, 20 inches
Cost: \$80,000,000
Rihimaki across Gulf of Bothnia to Gavle, Sweden

Kombinat Gasanlagen

Germany
155 miles, medium diameter
Cost: \$40,000,000
Philipshthal to Sayda

Wintershall AG

Germany
350 miles, large diameter
Cost: \$200,000,000
Rysum to Ludwigshafen

State Oil and Gas Trust

Hungary
200 miles, 28 to 32 inches
Cost: \$125,000,000
Boredoroc to Szeged

300 miles, large diameter
Grid linking Hungary, Austria, Czechoslovakia and Yugoslavia

Gas Authority of India Ltd.

India
900 miles, large diameter
Bombay to Bangalore
7,500 miles, large diameter
National gas grid
Cost: \$3,000,000,000

Pertamina

Indonesia
839 miles, 24 and 30 inches
545 miles, 24 inches. Block B fields, South China Sea, to Matak, Batam and Duri oil field in Sumatra, Phase 2, 294 miles, 30 inches. Natuna field to Natuna Island and Matak
Cost: \$2,000,000,000

National Iranian Oil & Gas Co.

Iran
1,900 mile line from Iran to Pakistan, India, and possibly China
Cost: \$11,000,000,000
World Bank to aid financing

Korea Gas Corp.

Korea
825 miles, large diameter
Cost: \$2,200,000,000
Network connecting 20 major cities

Agip

Libya
350 miles, large diameter
Cost: \$3,500,000,000
Bourri field offshore Libya to Italy

Libyan government

Libya
448 miles, 30 inches
400 miles, al Brika to Khoma
48 miles, 30 inches, sirte basin
Cost: \$2,000,000,000

Trans Mexico

Mexico
1,315 miles, 30 inches
Cost: \$1,000,000,000
Line following Mexico-U.S. border, laterals to U.S. border

Midgard Field Partners

Norway
300 miles, large diameter
Cost: \$300,000,000
Midgard field to existing Norwegian gas grid

Norske Shell

Norway
100 miles, large diameter
Cost: \$50,000,000
Troll field to processing plant at Oeygarden or Bergen

Qatar Pakistan
1,000 mile gas line from Qatar to Karachi, Pakistan. Feasibility study completed
Cost: \$3,000,000,000

Trinidad Tobago

Trinidad Tobago
800 miles, large diameter
Cost: \$2,500,000,000
Trinidad to Puerto Rico to other Caribbean islands

Sydkraft

U.S.S.R., Sweden
400 miles, large diameter
Cost: \$350,000,000
Eastern U.S.S.R. through Latvia, across the Baltic Sea to southeast Sweden

U.S.S.R.

U.S.S.R.
1,075 miles, large diameter
375 miles from Stokmanovskoye field in Barents Sea to Murmansk; 650 miles from Murmansk to Leningrad
Cost: \$3,000,000,000

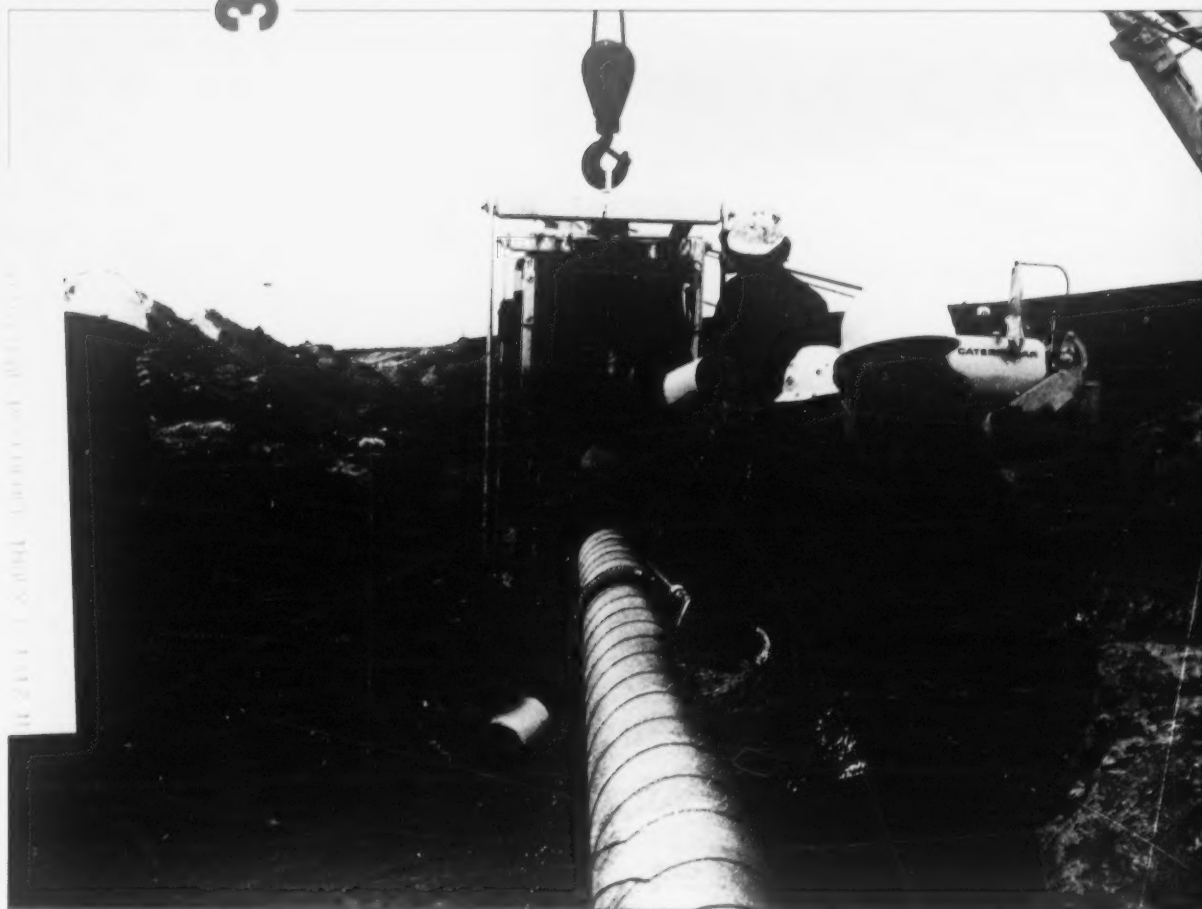
U.S.S.R. Korea

U.S.S.R. Korea
2,700 miles, large diameter
Cost: \$3,000,000,000
Vilyui in Eastern Siberia to North and South Korea

Pipeline & Utilities Construction

JANUARY 1992

3



Pipeline Construction Review/Forecast

- U.S., Canadian, and International Construction Outlook
- PLCA Convention Preview

Pipeline & Utilities Construction

January 1992

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Number 1A



On the cover: Tape-wrap machine applies protective cover during reconditioning of an in-service gas line in Wyoming.



Page 27: A John Henry rock drill sets blast holes on a rocky stretch of the Iroquois natural gas line upstate New York.



Page 30: A swivel-mounted barrel reamer prepares to pull back natural gas pipe on a crossing of a four-lane highway near Houston's Intercontinental Airport.

FEATURES

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PIPELINE REVIEW

Ups and Downs Balance Pipeline Picture for 1991

Pipeline construction in 1991 rose from the previous year's total as upheavals in world events dramatically influenced the petroleum and natural gas industries.

Although worldwide figures proved to be much lower than projected, mostly due to the Persian Gulf War, U.S. mileage rose from last year's total of 4,000 miles to 6,591 miles thanks to the completion of several major projects including Kern River, Mojave, and Iroquois. Canadian mileage stayed almost even, with this year's total of 1,699 miles comparing to 1,739 last year. International figures showed a substantial loss, with 2,440 miles of pipeline this year as opposed to 3,971 last year.

In the United States, 4,333 miles of natural gas line was constructed, as compared to last year's total of 2,468. Products lines rose from 383 to 839 miles, yet crude oil slipped from 258 miles to 215 miles. More miles of pipeline were rehabilitated or repaired on the domestic front, with 1,204 miles in 1991 compared to 891 in 1990.

Canada showed 1,659 miles of new natural gas lines built, almost even with last year's total of 1,697. Product lines, nonexistent in 1990, were up with 15 miles constructed. Crude oil lines slipped from 42 to 25 miles.

Worldwide, natural gas pipeline construction totaled 1,894 miles, down from 1990's total of 2,452 miles. Product lines dropped also, from 374 down to 183 miles. Crude oil lines were severely down, again as a result of the Middle East conflict. Only 363 miles of crude lines were built, as opposed to 1,145 last year. The majority of the construction came from Europe and the Pacific Rim.



Pipeline Construction for 1991

	Natural Gas	Products	Crude Oil	Replacement/Repair	TOTAL
U.S.	4,333	839	215	1,204	6,591
CANADA	1,659	15	25	--	1,699
INTERNATIONAL	1,894	183	363	--	2,440
WORLD TOTAL	7,886	1,037	603	1,204	10,730

PIPELINE FORECAST

Worldwide Pipeline Construction to Increase in 1992

U.S. and Canadian mileage to have moderate decline

By Oliver Klinger Jr.

The pipeline industry should have a year of continued growth worldwide in 1992 with continued substantial activity in gas pipelines, but with fewer major projects under construction. Water and sewer pipelines will be aided by projected additional federal funding as part of the Bush administration's program to accelerate construction work in general.

At present, the worldwide total for new pipelines planned is 36,436 miles to cost \$14,940,001,000. This compares with 25,384 miles and \$13,561,040,000 forecast for 1991 a year ago.

In the United States, the planned new mileage of 19,321 miles is well above the 9,534 planned a year ago for 1991, even with the completion in 1991 of a number of major gas line projects. The 1992 cost estimate is \$5,887,353,000, an increase over the \$5,096,023,000 for 1991.

The forecast for international pipelines is considerably higher at 15,418 miles and \$7,413,430,000 against 12,841 miles and \$5,087,470,000 for 1991.

Pipeline work in Canada will be down considerably at 1,087 miles and \$1,556,500 for 1992, well below the 3,009 miles and \$377,547,000 for 1991. We believe this esti-

mate for 1992 is a bit on the low side and actual work could be higher.

The major U.S. gas pipeline project will be Pacific Gas Transmission Co.'s 742-mile, 42-inch line from the Canadian border to the San Francisco area. If Canadian authorities approve, the 620-mile, 30-inch Altamont gas line from Canada which will hook up with the Kern River system at Opal, Wyo., could also get under way.

Florida Gas Transmission Co. has a huge 800-mile project to supply additional gas to Florida users, but this may not get underway until 1993. One of the two big 800-mile gas lines proposed in Alaska should go, but probably not until 1993.

Northwest Pipeline Co. plans 468 miles of 24-inch gas line to cost \$372,000,000, while Colorado Interstate Gas Co. has 223 miles of 20-inch to cost \$85,000,000. Natural Gas Pipeline Co.'s plans include 115 miles of new line to cost \$130,000,000.

CNG Transmission will lay 80 miles and add 45,000 compression horsepower to cost \$206 million. Trans Colorado Gas Co.'s proposed system will have 310 miles of 20-inch line to cost \$210,000,000, and Transwestern Pipe Line will have 92 miles of 30-inch to cost \$95 million.

International Work to Boom

Canada should have a fair volume of work with additional gas line capacity needed to supply the U.S. West and East Coast markets. Conversion of the Sarnia-Montreal oil line to gas service seems likely also. Trans Mountain Pipe Lines has plans for some new oil pipeline also. Trans Canada Pipe Lines plans 648 miles of big-inch lines to cost \$1,492,000,000.

The largest area of pipeline construction in 1992 will be in the international area. Many hundreds of miles of new lines are needed in Eastern Europe and there will be a substantial volume of work in Iran, the Middle East, Africa, and Latin and South America. Many major projects are maturing in South America.

The big Europipe system to supply Norwegian gas to European markets will be constructed. In Greece, a 510 km gas line will be built from the Bulgarian border to Athens. The Transmediterranean gas line from Algeria to Sicily and across the Messina Straits to Italy will be constructed and a number of new lines are planned in Italy.

The very substantial increase in European gas demand has resulted in a reported 8,000 km of new pipeline construction in 1991, with some 15,000 km of planned pipelines under consideration in 1992 and future years.

UNITED STATES

Gas Transmission	4,098	\$ 3,783,725,000
Gas Mains/Distribution	14,395	1,800,000,000
Products	336	12,838,000
Crude	492	290,790,000
Total (New Construction)	19,321	5,887,353,000
Repair/Rehab/Replacement	610	82,718,000
Grand Total	19,931	\$ 5,970,071,000

CANADA

Gas Transmission	817	\$ 1,550,200,000
Gas Distribution	260	6,300,000
Grand Total	1,087	\$ 1,556,500,000

INTERNATIONAL

Gas Transmission/Distribution	6,794	\$ 3,832,797,000
Products	5,296	1,378,003,000
Crude	3,009	1,883,600,000
Total (New Construction)	15,009	7,094,400,000
Repair/Rehab/Replacement	319	319,030,000
Grand Total	15,418	7,413,430,000
TOTAL WORLDWIDE	36,436	\$ 14,940,001,000

1992 PIPELINE FORECAST

DOMESTIC CRUDE

Ashland Pipe Line Co.

Replacement
27 miles, 6-, 8- and 16-inch
Cost: \$14,844,000
Wyandot, Crawford, and other
counties in Ohio

Citgo Petroleum Corp.

Repair/rehab
Cost: \$800,000
Various locations

Diamond Shamrock Oil Co.

Transmission
270 miles, 14-inch
Cost: \$40,000,000
Wichita Falls to Dumas, Texas

Marathon Pipe Line Co.

Transmission/gathering
3 miles, Various inches
Cost: \$790,000
Gulf of Mexico-South Pass Block
Repair/rehab
Cost: \$212,000
Yates Field, Texas

Mobil Oil Corp.

West Coast Pipe Lines

Replacement
65 miles, 16-inch O.D.
Cost: \$52,000,000
Los Angeles County, Calif.

Trans Mountain Oil Pipeline Co.

Transmission
219 miles, 24- and 36-inch
Cost: \$250,000,000

Low Point to Anacortes, Wash.
Burlington to Low Point, Wash.

FOREIGN CRUDE

Fina Petroleos de Angola

Angola
Transmission
12 miles, 6- and 8-inch
Cost: \$600,000
Sereia to Quimbuena
Ganda Kitona to Pangala
Replacement
6 miles, 4-inch
Cost: \$290,000
Cabeica da Corba

Sonatrach

Algeria
235 miles, 34 inches
Cost: \$200,000,000
Ispaid el Hania to Skikda

Petrobras

Brazil
22 miles, oil line
Cost: \$260,000,000
Sao Paulo to Santos

China National Oil Corp.

China
180 miles, 20 inches
Cost: \$80,000,000
Zhongyuan field to Luoyang
Henan refinery

Cuban government

Cuba
116 miles, 20 inches

Mianzas terminal to refinery
at Cienfuegos

Chemopetrol

Czechoslovakia
Transmission
217 miles, Various inches
Cost: \$200,000,000
Ingolstadt, Germany, to
Kralupy Vator, Bohemia

Conoco Ecuador, Ltd.

Ecuador
Dual 100 mile lines
Cost: \$200,000,000
Oriente region

Kenya Pipeline Co., Ltd.

Kenya
225 miles, 8 inches
Cost: \$100,000,000
Extend Mombasa-Nairobi line
to Uganda border

Korea Ministry of Energy and Resources

Korea
540 miles, large diameter
Cost: \$450,000,000
Western Pipeline: Yeosu to Seoul
Eastern Pipeline: Onsan to Seoul

Societe Cherifienne des Patroles

Morocco
115 miles, 14 inches
Cost: \$8,000,000

Port of Mohammedia to Side
Kacem refinery

Chevron Corp.

New Guinea

163 miles
Cost: \$125,000,000
Kutubu to terminal at Gulf of Papua

National Nigerian Petroleum Corp.

Nigeria
308 miles, 12-16 inches
Cost: \$250,000,000
Port Harcourt to River Niger

Shell Petroleum Development Co.

Nigeria
7 miles, 8 inches
43 miles, 20-24 inches, Opukushi
to Forcados
6 miles, 8 inches, flow station
to Ogara
6 miles, 8 inches, to Kanbo
manifold
Cost: \$5,000,000

Chinese Petroleum Corp.

Taiwan
40 miles, 12-20 inches crude
and products line to oil
terminal
Cost: \$5,000,000

Botas

Turkey
570 miles, large diameter
Looping of oil line from Iraq
to Turkey

DOMESTIC PRODUCTS

Chevron Pipe Line Co.

Repair/rehab
275 miles, Various inches
Various locations in Texas

Fremont Dept. of Utilities

Rehab
7 miles, 2-inch
Cost: \$375,000
Fremont, Neb., distribution mains

Mid-America Pipeline Co.

Gathering
5 miles, 4-inch
11,300 HP
Cost: \$5,838,000
Big Spring, Texas

Quest Enterprises Inc.

Transmission
23 miles, 16-inch
Mont Belvieu, Texas

Santa Fe Pacific Pipelines

Distribution
33 miles, 12-inch
3,400 HP
Cost: \$7,000,000
Arizona

FOREIGN PRODUCTS

Ecopetrol

Colombia
119 miles, 6-12 inches
Cost: \$30,000,000
Three lines: Medellin to Rionegro,
Facativato Villavicencio,
Sébastienopol to Medellin

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Rhone
France
94 miles, 12 inches



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TRAPIL

France
Transmission
22 miles, 16-inch
5,400 HP
Cost: \$17,000,000
Gargenville to Cognères, France

Shell Multi-Partner Venture

Germany
Transmission
270 miles, 20-inch
Cost: \$400,000,000
Hamburg to Dresden, Germany

Petromin

Indonesia
650 miles, 10 inches
Cost: \$75,000,000
Trans Java network

National Iranian Oil Co.

Iran
1,140 miles, 12 inches
Cost: \$90,000,000
Arak to Malayer and Mamadan

Tamoli Italia SpA

Italy
Repair/rehab
63 miles, 12-inch
Cost: \$250,000
Cremona, Italy

Kenya Pipelines Co. Ltd.

Kenya
355 miles, 6-8 inches

Cost: \$40,000,000
Nairobi to Kisumu Eldoret

Korea Petroleum Development Corp.

Korea
541 miles products line network
Cost: \$25,000,000
Yosu and Onsan to Seoul

Petronas-Petroleum Nasional Berhad

Malaysia
Transmission
129 miles, 8 to 18-inch
45,800 HP
Cost: \$240,000,000
Bayan, Seligi, and Guntong, Malaysia

Nigerian National Oil Corp.

Nigeria
Distribution
33 miles, 16 inches
Bonny terminal to Port Harcourt
309 miles, 12-16 inches
Port Harcourt, Enugu, Auchi, to Benin City
Cost: \$140,000,000

Petroleos Del Peru

Peru
52 miles, 4-6 inches
Aguaytia to Pucallpa Campo
30 miles, 3 inches
Aguaytia to Campo Verde
Cost: \$3,000,000

Campsas

Spain
13 miles, 8 inches

Almodovar to Merida
60 miles, 10 inches
Alicante to Cartagena
90 miles, 10 inches
L-1 Coruna to Vigo
Cost: \$20,000,000

General Petroleum Corp.

Sudan
Transmission
500 miles, 8-inch
1,800 HP
Cost: \$1,000,000
Port Sudan to Khartoum
Replacement
3 miles, 8-inch
Cost: \$330,000
Area near Port Sudan

Corpovent SA

Venezuela
373 miles, medium diameter
Cost: \$100,000,000
Puerto la Cruz refinery to Maturin, San Tome, Ciudad Bolivar, Puerto Ordaz, Puerto Ayacucho

Maraven SA

Venezuela
258 miles, 12 inches
Cost: \$75,000,000
San Lorenzo, Lake Maracaibo to El Viga and Tachira

Lonrho PLC

Zimbabwe
135 miles, 10 inches
Cost: \$30,000,000
Feruka to Harare

Petrozim Ltd.

Zimbabwe
Transmission
123 miles, various inches
Cost: \$67,000,000
Feruka to Harare, Zimbabwe

DOMESTIC NATURAL GAS

ANR Pipeline Co.

Transmission
41 miles, 8 to 36 inches
Cost: \$36,800,000
Michigan and Wisconsin
Replacement
2 miles, 22- and 30 inches
Cost: \$3,500,000
8,550 HP
Cost: \$9,000,000
Various locations in Iowa and Indiana

Altamont Gas Transmission Ltd.

Transmission
620 miles, 30-inch
Wild Horse, Mont. to Opal, Wyo.

Arkla Inc.

Replacement
29 miles, 16-inch
Cost: \$9,000,000
Line 2 in Oklahoma

CNG Transmission Corp.

Transmission
80 miles, 24- and 30 inches
45,050 HP
Cost: \$206,000,000

Several counties in Ohio and Pennsylvania

Colorado Interstate Gas Co.

Transmission
223 miles, 20-inch
Cost: \$85,000,000
Wyoming, Colorado, and Utah

Columbia Gulf Transmission Co.

Repair/rehab
1 mile, 30- and 36 inches
Cost: \$887,000
Evangeline Parish, La. and Mississippi

Florida Gas Transmission Co.

Transmission
540 miles, 36-inch
Cost: \$750,000,000
Texas, Louisiana, Mississippi, Alabama, and Florida

Gateway Pipeline Co.

Transmission
25 miles, 30-inch
Cost: \$21,700,000
Mobile Bay area

Gatz Terminals Corp.

Transmission
120 miles, 10-inch
Cost: \$20,000,000
Tampa to Ft. Myers, Fla.

Natural Gas Pipeline Co. of America

Transmission
115 miles, 30-inch
8,000 HP



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1992 PIPELINE FORECAST

Cost \$ 130,000,000
Near Harper, Iowa

Northern Border Pipe Line Co.
Transmission
80,000 HP
Cost \$ 200,000,000

Northwest Pipeline Co.
Transmission
468 miles, 24-inch
150,000 HP
Cost \$ 372,000,000
21 spreads in various locations

Ozark Gas Transmission System
Transmission
10,000 HP
Cost \$ 17,000,000

Pacific Gas Transmission Co.
Transmission
800 miles, 42-inch
Cost \$ 760,000,000
Add 105,000 HP
Cost \$ 142,500,000
Kingsgate, British Columbia to California

Questar Pipeline Co.
Distribution
44 miles, 20-inch
Cost \$ 50,000,000
Various locations in the United States

Southern California Gas Co.
Transmission
1 mile, 16-inch
Cost \$ 1,600,000
Wilmington, Calif.

Repair rehab
14 miles, 18- to 30-inch
Cost \$ 17,300,000
Various locations in Southern California
Add 10,000 HP
Cost \$ 23,600,000

Tenneco Gas Pipeline Co.
Transmission
82 miles, 10- to 36-inch
Cost \$ 139,000,000
New York, Massachusetts, Rhode Island, and Pennsylvania
Repair rehab
319 miles, 8- to 30-inch
Cost \$ 11,000,000
22,200 HP
Cost \$ 21,000,000
New York, Massachusetts, Connecticut, and Louisiana

TransColorado Gas Transmission Co.
Transmission
310 miles, 20-inch
Cost \$ 210,000,000
Northern Colorado fields to New Mexico

Transco Inc.
Transmission
14 miles, 16- to 42-inch
12,600 HP
Middlesex, Burlington, and Camden Counties, N.J., Lycoming County, Pa.
Repair rehab
1 mile, 20- to 36-inch

Pennsylvania, Georgia, and Alabama

Transwestern Pipe Line Co.
Transmission
97 miles, 30-inch
12,400 HP
Cost \$ 95,000,000
San Juan Basin area

Western Gas Supply Co.
Transmission distribution
33 miles, Various inches
2,100 HP
Cost \$ 6,625,000
Breckenridge, Durango, and Rifle, Colo.

Yukon Pacific Corp.
Distribution
800 miles, 42-inch
Cost \$ 900,000,000
Prudhoe Bay to Valdez, Alaska

CANADA NATURAL GAS

Inland Natural Gas Co. Ltd.
Canada
23 miles, 8- to 42-inch
5,200 HP
Cost \$ 51,800,000
Cranbrook and Vancouver, British Columbia
Repair rehab
50 miles, 10-inch
Cost \$ 1,000,000
Various locations in British Columbia

TransCanada PipeLines
Canada
646 miles, 12- to 48-inch
15,630 HP
Cost \$ 1,492,000,000
Alberta, Manitoba, Ontario, and Quebec

Westcoast Energy Inc.
Canada
98 miles, 6- to 36-inch
Cost \$ 5,700,000
Ft. Nelson and Ft. St. John, British Columbia

FOREIGN NATURAL GAS

Sagasco Holdings Ltd.
Australia
Transmission
81 miles, 20-inch
Cost \$ 50,000,000
Bass Straits Field to Tasmania

Bolivian Government
Bolivia
1,020 miles, 24-inch
Cost \$ 1,700,000,000
Bolivia to Brazil

Sulgas Brasil
Brazil
720 miles, various inches
Cost \$ 1,700,000,000
Sao Borja to Porto Alegre, Brazil

National Iranian Gas Co.
Iran

1800 miles, Various inches
100,000 HP
Cost \$ 250,000,000
Various locations in Iran

Bord Gais Ireann
Ireland
114 miles, 24-inch
Ireland to Scotland

Europipe Statoil
Norway
469 miles, 36- and 40-inch
North Sea to Germany

Statoil Conoco
Norway
152 miles, 20-inch
Cost \$ 60,000,000
Hedrun to Trondheim, Norway

Petronet
South Africa
65 miles, 8- to 12-inch
7,000 HP
Cost \$ 450,000,000
Alberton to Rustenburg via Tarlton, Transvaal

Statoil Neste Stobee
Sweden
576 miles, Various inches
Cost \$ 600,000,000
Trondheim to Stockholm
Various locations in Norway

Chinese Petroleum Corp.
Taiwan
66 miles, 10- to 24-inch
Ta-Lin, Chen-Zen, and Hsiao-Kang Airport

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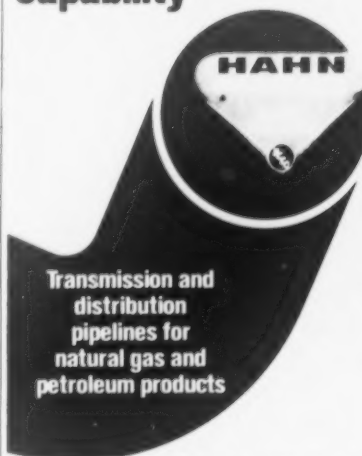
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Petroleum Authority of Thailand

Thailand
Distribution
209 miles, 24- and 30-inch
Cost: \$150,000,000
Offshore Erawan to terminal at
Surat Thani

Esso Petroleum Co. Ltd.

United Kingdom
29 miles, 12-inch
1,500 HP
Astwood or Redditch to
Bromford, Birmingham
Repair
70 miles, 10- and 12-inch
Southern England

Vietgas

Vietnam
80 miles, 20-inch
Cost: \$240,000,000
Bach Ho field

**DOMESTIC
GAS DISTRIBUTION**
Adobe Gas Pipeline Co.

Gathering
17 miles, 3-, 4- and 6-inch
Cost: \$210,000
West Texas and Montana

Battle Creek Gas Co.

Distribution
5 miles, 2- and 4-inch
Cost: \$231,000
Battle Creek, Mich.
Replacement

8 miles, 2-, 4-, 6- and 8-inch
Cost: \$677,000
Battle Creek, Mich.

Citizens Gas Fuel Co.

Gathering
5 miles, 2- to 4-inch
Cost: \$143,000
Various locations in Michigan
Repair/rehab
2 miles, 3- and 4-inch
Cost: \$53,000
Various locations in Michigan

City of Florence Gas Dept.

Repair/rehab
1 mile, 6-inch
Downtown Florence, Ala.
Transmission distribution
8 miles, 4- and 6-inch
State Hwy 17 to Zip City, Ala.
and vicinity

City of Mesa, Ariz.

Gathering
3 miles, 2- and 4-inch
Cost: \$700,000
Various locations in the city
Rehab
1 mile, 2- and 4-inch
Cost: \$200,000
Queen Creek area of Mesa

City of Springfield Utilities

Distribution
7 miles, 4- and 8-inch
Cost: \$700,000
Willard, Mo.
Repair/rehab
10 miles, 2- to 4-inch

Cost: \$1,500,000
Southeastern portion of
Springfield, Mo.

Colorado Interstate Gas Co.

Distribution
223 miles, 24-inch
Cost: \$200,000,000
Eastern Utah to southern
Wyoming

Colorado Springs Department
Public Util. Gas

Gathering
12 miles, Small-inch
Cost: \$997,350
Colorado Springs, Colo.
Repair/rehab
26 miles, Small-inch
Cost: \$2,388,400
Colorado Springs, Colo.

Commonwealth Gas Co.

Distribution
2 miles, 2- and 4-inch
Cost: \$4,021,000
Worcester and Uxbridge, Mass.
Repair/rehab
4 miles, 2-, 4- and 8-inch
Cost: \$10,655,000
New Bedford, Holliston, and
Dartmouth, Mass.

Connecticut Natural Gas

Distribution
19 miles, 2- to 16-inch
Cost: \$3,975,000
Hartford and Greenwich, Conn.
Repair/rehab
32 miles, 2- to 16-inch

Cost: \$655,000
Hartford and Greenwich, Conn.

Exxon Gas Systems Inc.

Recoating
30 miles, 36-inch
Cost: \$6,000,000

Frederick Gas Co.

Transmission distribution
21 miles, 2- to 8-inch
Cost: \$2,056,550
Frederick city and county areas
Maryland
Repair/rehab
3 miles, 2-, 4- and 6-inch
Cost: \$403,300
Frederick, Md.

Gulf States Utilities Co.

Gathering
8 miles, Various inches
Cost: \$280,000
East Baton Rouge Parish, La.
Repair/rehab
9 miles, 2- to 6-inch
Cost: \$1,217,000
East Baton Rouge Parish, La.

Middle Tennessee Utility District

Distribution
110 miles, 2-, 4- and 6-inch
Cost: \$3,000,000
Various locations in Texas

Mobile Gas Service Corp.

Gathering
11 miles, Small-inch
Cost: \$4,229,200
Mobile County, Ala.

Replacement
19 miles, 1.25- to 12-inch
Cost: \$600,000
Mobile County, Ala.

Montana-Dakota Utilities Co.

Replacement
28 miles, Various inches
Cost: \$1,780,157
North Dakota, South Dakota,
Montana, and Wyoming
Transmission distribution
89 miles, Various inches
1,100 HP
Cost: \$8,171,307
Valley City, N.D. to Mapleton, N.D.
North Dakota, South Dakota,
Montana, and Wyoming

New Jersey Natural Gas Co.

Distribution
155 miles, 2- to 30-inch
Cost: \$38,038,506
Various locations in New Jersey
Repair/rehab
54 miles, 2- to 6-inch
Cost: \$4,004,847
Various locations in New Jersey

New York State Electric and Gas

Transmission distribution
128 miles, Various inches
Cost: \$8,986,000
Various districts in NYSEG's
system

Distribution
8 miles, Various inches
Cost: \$4,325,000

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1992 PIPELINE FORECAST

Various districts in NYSEG's system

Peoples Gas System Inc.

Repair rehab
15 miles: 2- to 6-inch
Cost: \$ 4 200 000
Various locations in Florida
Transmission distribution
27 miles: 2- 4- and 8-inch
Cost: \$ 10 000 000
Various locations in Florida

Rochester Gas and Electric Corp.

Distribution
50 miles: 2-inch
Cost: \$ 2 200 000
Rochester, N.Y.
Repair rehab
10 miles: 4- to 8-inch
Cost: \$ 2 600 000
Rochester, N.Y.

Seagull Energy Corp.

Gathering
32 miles: 10- and 12-inch
Gulf of Mexico Brazos area

St. Joseph Power and Light Co.

Distribution
1 mile: 2-inch
Cost: \$ 13 000
St. Joseph, Mo.
Replacement
3 miles: 5- to 2-inch
Cost: \$ 290 000
Maryville, Mo.

TEPPCO

Distribution
13 miles: 6-inch
Greater Cincinnati
Northern Kentucky International Airport

Virginia Natural Gas Co.

Repair rehab
1 mile: Various inches
Cost: \$ 1 500 000
Various locations in Virginia

Williams Natural Gas Co.

Transmission
65 miles: 8- to 20-inch
Cost: \$ 20 000 000
Various locations in Kansas

Wilmington Gas and Oil Co.

Distribution

1 mile: 2- 4- and 6-inch
Cost: \$ 23 459
Hattiesburg, Miss.

Wisconsin Natural Gas Co.

Distribution
25 miles: 10- to 20-inch
Cost: \$ 15 500 000
Menasha, Waukesha, Mukwonago, and Watertown, Wisconsin
Repair rehab
5 miles: 6- and 8-inch
Cost: \$ 3 600 000
Kenosha, Wisconsin

Yankee Gas Services Co.

Gathering
9 miles: 2- to 6-inch
Cost: \$ 1 400 000
Various locations in Connecticut
Replacement
13 miles: Various inches
Cost: \$ 4 705 000
Various locations in Connecticut

CANADA GAS DISTRIBUTION

Centra Gas Alberta Inc.

Canada
260 miles: 50- to 4-inch
Cost: \$ 6 300 000
Various locations in Alberta

FOREIGN GAS DISTRIBUTION

Gas & Fuel Corp. of Victoria

Australia
Distribution
145 miles: Various inches
Cost: \$ 15 000 000
Various locations in Victoria

South Australia Gas Co.

Australia
Repair rehab
25 miles: 6-inch
Cost: \$ 2 500 000
Adelaide, South Australia

Ver. Energiebedrijven

Scheideveld (EBES)
Belgium
Distribution
132 miles: Various inches
Cost: \$ 11 000 000

Ver. Energiebedrijven

Scheideveld (EBES)
Belgium
Repair rehab
31 miles: 2- to 8-inch
Cost: \$ 3 600 000

Pertamina

Indonesia
Distribution
270 miles: various inches
Cost: \$ 120 000 000
Offshore Kangea to Bali, Surabaya, and Gresik

Korea Gas Co.

Korea
Distribution
857 miles: Various inches
Cost: \$ 200 000 000
Various locations in Korea

Singapore Petroleum Co. Pte. Ltd.

Singapore
Repair
1 mile: 12-inch
Cost: \$ 180 000
Supports and lines between marketing terminal and tanker berth

Patrol Zemljski Plin D.O.O.

Yugoslavia
Distribution
9 miles: small-inch
Cost: \$ 1 797 000
Novo mesto, Gornik, and Sevnica, Yugoslavia

DOMESTIC WATER

City of Virginia Beach, Va.

Transmission
85 miles: 60-inch
Cost: \$ 219 000 000
Lake Gaston to Virginia Beach, Va.

FOREIGN WATER

Water Planning for Israel

Israel
Transmission
126 miles: 6- to 54-inch
42 700 HP
Cost: \$ 70 000 000
Ran, Shaveh, Lathin, and Daniel, Israel

Petroleos de Portugal

Portugal
Transmission
5 miles: 6- and 10-inch inches
Cost: \$ 330 000
Oporto Refinery Oporto Airport area - Porto Brandao, Lisbon

PENDING PROJECTS BEYOND 1992

DOMESTIC CRUDE

Pacific Pipeline Systems Inc.

Transmission
120 miles: 20-inch
Cost: \$ 50 000 000
Gaviota to Wilmington, Calif.

CANADA CRUDE

Alberta Energy Co. Ltd.

Canada
Distribution
6 miles: 12-inch
Cost: \$ 3 000 000
Husky Terminal, Alberta

FOREIGN CRUDE

Broome Oil Pipeline Systems

Australia
300 miles: medium diameter
Cost: \$85 000 000
Canning basin area of Western Australia

National Iranian Oil Co.

Iran
600 miles: large diameter
Cost: \$500 000 000
Gach Siah field near Persian Gulf to Port of Jask, Gulf of Oman

Shell Pipeline Petroleum Dev.

Nigeria
43 miles: 20-24 inches
Cost: \$50 000 000
Opokushi to Forcados terminal

Tazama Pipeline Ltd.

Tanzania
670 miles: 8-24 inches
Cost: \$201 000 000
Tanzania to Zambia

Botas

Turkey
2 976 miles: large diameter
Cost: \$2 500 000 000
Agajari to Iskenderun Gulf (between Iran and Turkey)

DOMESTIC PRODUCTS

Chevron Pipe Line Co.

Gathering
9 miles: 8-inch
Fina to Warren, Calif.

Colonial Pipeline Co.

Transmission
45 miles: 12-inch
Cost: \$ 40 000 000
Badinbridge, Ga. to Jefferson County, Fla.

CANADA PRODUCTS

Interprovincial Pipe Line Inc.

Canada
Transmission
145 miles: unknown inches
Cost: \$ 145 000 000
Quebec City to Montreal

FOREIGN PRODUCTS

Sonatrach

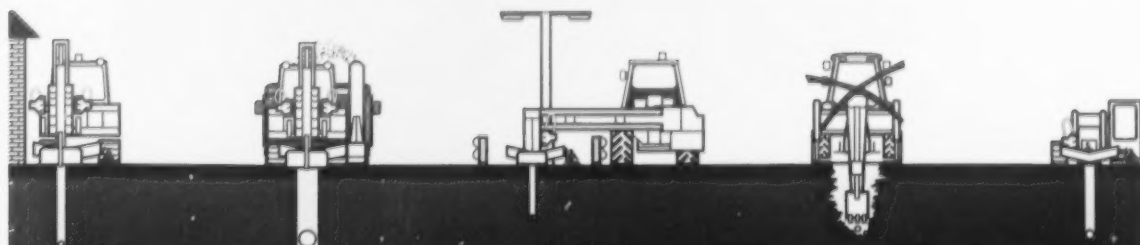
Algeria
500 miles: medium diameter
Cost: \$125 000 000
Southeast Algerian fields to Hassi Messaoud

Oil India Ltd.

India
826 miles: medium diameter
Cost: \$200 000 000
Khandia to Bhatinda

Laos government

Laos



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KUKLA TRENCHERS

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1992 PIPELINE FORECAST

260 miles, medium diameter
Cost: \$85,000,000
Vinh: Vietnam to Vientiane, Laos

Statoil

Norway
140 miles, 20 inches
Cost: \$420,000,000
Condensate line from Sleipner field to Kristian

British Petroleum

United Kingdom
150 miles, 24 inches
Cost: \$100,000,000
Bruce field to Forties field
UK North Sea

DOMESTIC TRANSMISSION

Panhandle Eastern Corp.

Transmission replacement
126 miles, 8- through 36 inch
59, 150 HP
Cost: \$210,000,000
Various locations in Ohio, Pennsylvania, West Virginia and New Jersey

Tenneco Gas Pipeline Co.

Transmission
1,000 HP
Station 264 in Charlton, Mass

FOREIGN TRANSMISSION

Abu Dhabi National Oil Co.

Abu Dhabi
93 miles, 28 inches
Cost: \$50,000,000
Magda to Al Ain

Algeria, Spain, Morocco

1,265 miles, 20-24 inches
Cost: \$1,300,000,000
Algeria to Morocco under Mediterranean Straits, starting at Hassi R Mel field in Algeria ending at Seville, Spain, 300 miles
Hassi R Mel field to Morocco, 900 miles through Morocco across Straits of Gibraltar to Seville

Sonatrach

Algeria
300 miles, 24 inches
Cost: \$200,000,000
Hassi R Mel field to Moroccan border

Argentine government

Argentina
600 miles, 10-24 inches
Cost: \$300,000,000
Campo Duran to Chaco, Argentina

Gas del Estado

Argentina
350 miles, 18 inches
Santa Fe, Argentina, to Montevideo, Uruguay
775 miles, 30 inches
Salta Province, Argentina, to Rio Grande do Sul state, Brazil
Cost: \$300,000,000

Auckland Gas Co.

Australia
40 miles, 1-6 inches
Cost: \$5,000,000
Auckland area

Department of Resources & Energy

Australia
3,000 miles, large diameter
Cost: \$3,000,000,000
Transcontinental Australia pipeline

Doral Resources

Australia
50 miles, medium diameter
Cost: \$35,000,000
Onshore to Damp-Bunbury line

Gas & Fuel Corp. of Victoria

Australia
16 mile gas line and distribution lines in Singapore

Mt. Isa Mines Ltd.

Australia
500 miles, medium diameter
Cost: \$75,000,000
Copper Basin fields to Mt. Isa

Petronet

South Africa
17,000 HP
17 new pump stations in South Africa

Gas & Fuel Corp. of Victoria

Australia
80 miles, various sizes
Cost: \$20,000,000
Karrakoo to Portland, Victoria
209 miles, various sizes
Cost: \$16,000,000
Melbourne, Victoria

Magellan Petroleum Corp.

Australia
375 miles
Cost: \$150,000,000
Amadross-Darwin line to Gove

Pipeline Authority of S.

Australia
82 miles, 12 inches
Cost: \$40,000,000
Wagga Wagga to Albury, New South Wales

Petrobangla

Bangladesh
150 miles, 6, 16, and 20 inches
Cost: \$48,000,000
Kalashnia field to grid in Ashuganj

Distrigaz

Belgium
65 miles, 16 inches
Cost: \$5,000,000
Zeebrugge to Blankenfort

Energiebedrijven Schiedeland

Belgium
57 miles, 14-40 inches
Cost: \$40,000,000
Replacement Antwerp area

YPFB

Bolivia
330 miles, 24 inches
Cost: \$250,000,000
Santa Cruz to Brazilian border

Petrobras

Brazil
1,175 miles, large diameter
Cost: \$400,000,000
1,050 miles from Urutzu region to Carajas, 125 mile spur to Manaus
Extensions to Belem and Sao Luis could add 700 miles

Y.P.F.B. Petrobras

Brazil
1,010 miles, 24 inches
Cost: \$400,000,000

Brazil-Bolivia border to Sao Paulo, Brazil

TransAsean Consortium

Brunei-Indonesia-Malaysia-Philippines-Thailand
5,000 miles, large diameter
Cost: \$3,000,000,000
Fields offshore Thailand through Malaysia, Indonesia, and Brunei to the Philippines

China National Offshore Oil Corp.

China
60 miles, 30 inches
Cost: \$10,000,000

Yacheng field, South China Sea to Hainan Island, China
680 miles, 24 inches
Cost: \$300,000,000
Hainan Island to Guangzhou

Carbocel

Colombia
310 miles, 24 inches
Cost: \$600,000,000
San Cristobal, Venezuela to Bogota, Colombia

Ecopetrol

Colombia

58 miles, 20 inches
Cost: \$30,000,000
Davao to Bataan

Promigas

Colombia
821 miles, 20-24 inches
373 miles, 20 inches
248 miles, 24 inches
Cost: \$250,000,000
Davao to Bataan

Dansk Olie Og Naturgas

Denmark
67 miles, 10, 12, and 30 inch



Sunbelt Tractor & Equipment Co.



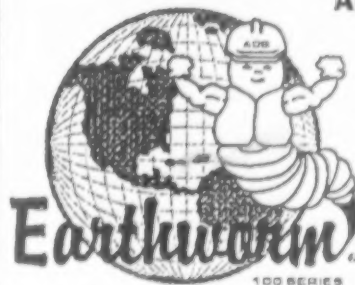
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1992 PIPELINE FORECAST

lines Cost: \$5,000,000	Cost: \$15,000,000 Salon to Mersa Matruh	EVG Germany 100 miles, 36" 10" inches Cost: \$80,000,000 Viziersdorf to Gera	Joint venture Wintershall OMV 348 miles, 30" inches Cost: \$250,000,000 Ryumin to Ludwigsfelde	Hungarian Oil & Gas Trust Hungary 22 miles, 21" inches Cost: \$20,000,000 Pisa to Dorog
Dubai Natural Gas Co. Dubai 200 miles, large diameter Cost: \$150,000,000 Gatar's North field to Jebel Ali Dubai	Ministry of Trade and Industry Finland 250 miles, 20" inches Cost: \$80,000,000 Ruhmala-järvi Gulf of Bothnia to Gäddede, Sweden	Erdgasversorgungsgesellschaft Germany 200 miles Cost: \$450,000,000 Viziersdorf to Friedland Saxony	Ruhrgas AG Germany 182 miles, 48" inches Werny to Buchsheim 48 miles, 40" inches Ludwigsfelde to Viziersdorf 18 1/2 miles, 24" inches Viziersdorf to Arften Cost: \$150,000,000	State Oil and Gas Trust Hungary 200 miles, 28-30" inches Cost: \$125,000,000 Borsodnád to Szeged 300 miles, large diameter Qnd mining Hungary, Austria, Czechoslovakia and Yugoslavia
Bapetco Egypt 74 miles, 16" inches 55 miles, 16" inch loop from BED-2 to Amariyah 19 miles, BED-2 to BED-3 Cost: \$60,000,000	Gaz de France France 44 miles, 24" inches Cost: \$30,000,000 Siam to Lacq	Kombinat Gasanlagen Germany 155 miles, medium diameter Cost: \$75,000,000 Phosphor to Snydk	Wintershall AG Germany 250 miles, large diameter Cost: \$300,000,000 Ryumin to Ludwigsfelde	Gas Authority of India Ltd India 400 miles, large diameter Bombay to Bangalore 7,800 miles, large diameter National gas grid Cost: \$3,000,000,000
Khalda Petroleum Co. Egypt 59 miles, 10" inches	BEB Germany 100 miles, medium diameter Cost: \$50,000,000 Achm to Salzweiden	Midas GmbH Germany		Gujarat Gas Co. Ltd. India 330 miles, medium diameter Cost: \$150,000,000 Gas network in Gujarat state

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Guarat Gas Co. Ltd. India 330 miles, medium diameter Cost: \$150,000,000 Gas network in Gujarat state	Oil and Gas Commission India 175 miles, medium diameter Cost: \$150,000,000 East and West Godavari districts of Andhra Pradesh 95 miles, medium diameter Cost: \$75,000,000 Southern deep, Western Offshore Integrated Development Project	Pertamina Indonesia 839 miles, 24 and 30 inches 545 miles, 24 inches, Block B fields, South China Sea, to Malak Balam and Duri oil field in Sumatra Phase 2: 294 miles, 30 inches Natuna field to Natuna Island and Malak Cost: \$2,000,000,000	National Iranian Oil & Gas Co. Iran 1,900-mile line from Iran to Pakistan, India, and possibly China Cost: \$11,000,000,000 World Bank to aid financing
Agip Italy 84 miles Cost: \$20,000,000 Libya - Bu Ahter field to gas treatment plant	Korea Gas Corp. Korea 825 miles, large diameter Cost: \$2,200,000,000 Network connecting 20 major cities	Agip Libya 350 miles, large diameter Cost: \$3,500,000,000 Bourn field offshore Libya to Italy	Libyan government Libya 448 miles, 30 inches 400 miles, at Brka to Khoma 48 miles, 30 inches, site basin Cost: \$2,000,000,000
Petronas Malaysia 109 miles, 30 inches			

1992 PIPELINE FORECAST

Coal \$100,000,000
Litho to Singapore, Westing to Raxo
Gudang
187 miles, 8, 8, 16, and 20 inches
Cost: \$345,000,000
Soviet to Raxo, offshore, Singapore

Trans Mexico

Mexico
1,215 miles, 36 inches
Cost: \$1,000,000,000
Line following Mexico U.S. border
separate to U.S. border

Ministry of Energy

New Zealand
140 miles, 14 inches
Cost: \$75,000,000
Huntly to Manawatu power stations

Midgard Field Partners

Norway
300 miles, large diameter
Cost: \$350,000,000
Midgard field to existing
Norwegian gas grid

Norske Shell

Norway
100 miles, large diameter
Cost: \$50,000,000
Troll field to processing plant
at Odegarden or Bergen

Statol

Norway
524 miles, 36, 40 inches, Zeeppe
line Slesphor to Zebrugge
Belgium 80 miles, 36 inches
Zeeppe Troll to Hemdis
95 miles, 40 inches, Zeeppe

Troll to Slesphor
180 miles, 36 inches, Slesphor
to Kattvik
Cost: \$1,300,000,000

Petroleum Development Co.

Qatar
66 miles, medium diameter
Cost: \$50,000,000
Lubantah field to terminal gas grid

Sui Gas Transmission Co.

Pakistan
160 miles, 30 inches
Cost: \$40,000,000
Sui to Kila Abd

Petroleos del Peru

Peru
354 miles, 26 inches
64 miles, 8 inches
Cost: \$50,000,000
Carmack Suez to El Niño Lima

Portuguese government

Portugal
300 miles
Cost: \$800,000,000
Lisbon to Braga near Spanish
border plus distribution systems
five year program

Qatar-Pakistan

Qatar-Pakistan
1,000 mile gas line from Qatar
to Karachi, Pakistan
Feasibility study completed
Cost: \$1,000,000,000

Enagas

Spain
300 miles, 26 inches

Cost: \$441,000,000
Suez to Madrid
200 miles, 12, 24 inches
Cost: \$40,000,000
Raxo, Nigeria area

Steed

Sweden
150 miles gas and oil around
Stockholm
Cost: \$20,000,000

Al-Furat Petroleum

Syria
315 miles, 8, 16 inches
275 miles, 16 inches, Ojar field
to Damascus
60 miles, 8, 12 inches to
Thayyari, Tadmor, Abu
Chayr, \$150,000,000

Trinidad Tobago

Trinidad Tobago
900 miles, large diameter
Cost: \$2,500,000,000
Trinidad to Puerto Rigo to other
Caribbean islands

Botas

Turkey
400 miles up to 12 inches
Bursa city distribution system
515 miles, large diameter, 315
miles, Bursa to Izmir and 215 miles
Izmir to Karabuk
Cost: \$150,000,000

Amoco Exploration Co.

United Kingdom
254 miles, 36 inches
Cost: \$225,000,000

Zemke Area Transmission
system: Everset and Lomon offshore
field to Teesside

Gas Transmission U.K. Ltd.

United Kingdom
180 miles, 30, 36 inches
Cost: \$150,000,000
Barton to Thames Estuary, east
of London

Kinetica Ltd. (Conoco PowerGen)

United Kingdom
175 miles, 36 inches
Cost: \$30,000,000
Chromford gas to power
stations

Scottish Area Gas Evacuation System (Sage)

United Kingdom
150 miles, 24 inch
Cost: \$475,000,000
Mid North Sea Marathon Oil
Beryl North Sea field to St. Fergus

Shell U.K. Exploration & Production

United Kingdom
116 miles, 24 inches
Cost: \$75,000,000
Barton to Great Haven refinery on
the Thames Estuary

Total Oil Marine

United Kingdom
110 miles, 20 inches
Cost: \$75,000,000
Carter field, UK North Sea
to Kongsberg

U.S.S.R. Sweden
400 miles, large diameter

Cost: \$350,000,000
Eastern U.S.S.R. through Latvia,
across the Baltic Sea to
southeast Sweden

U.S.S.R.

U.S.S.R.
1,075 miles, large diameter
375 miles from Stokmanovskaya
field in Barents Sea to Murmansk
650 miles from Murmansk to
Leningrad
Cost: \$1,000,000,000

U.S.S.R. Korea

U.S.S.R. Korea
2,700 miles, large diameter
Cost: \$3,000,000,000
Vityaz in Eastern Siberia to North
and South Korea

Petroleos de Venezuela

Venezuela
28 miles, 16 inches
Cost: \$5,000,000
Orinoco Marguery Basin fields
to Maracaibo

Energoinvest with IRA

Yugoslavia
80 mile line connecting eastern
and western gas networks
Cost: \$5,000,000

Yugoslavian government

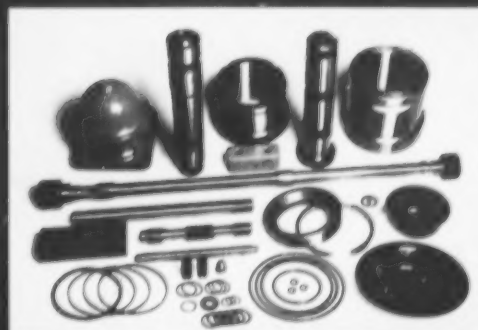
Yugoslavia
650 miles, small to medium
diameter, 160 miles main line,
415 miles main and distribution
lines, 75 miles urban mains
Cost: \$100,000,000

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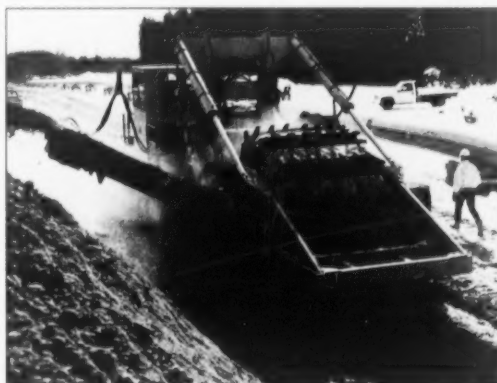
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On the cover:

Majestic Pipeliners uses seven-foot wide bite of Trencor-Jetco 1084 trencher to cut through muskeg for TransCanada's 42-inch natural gas line in Ontario, Canada.

OSHA Excavation Safety Activities

By Charles Culver, Director
Office of Construction and Engineering
Occupational Safety and Health Administration

Trenching and excavation are inherently dangerous activities. Their most obvious danger comes from excavated side walls that can suddenly collapse without warning, trapping or killing workers. Other hazards at trenching sites arise from the operation of construction equipment in or adjacent to the excavation, hazardous atmospheres or oxygen deficiencies, water accumulation, falling rock or soil, falls, and vehicular traffic.

An OSHA study of construction fatalities for the five-year period from 1985

to 1989 indicated seven percent of the 3,500 deaths investigated by the agency in all industries were associated with trenching and excavation. An average of 50 workers were killed each year during the period of the study.

The study went on to show that nearly 40 percent of trenching fatalities occurred in trenches less than 10 feet deep and 79 percent occur in trenches less than 15 feet deep (see Figure 1).

It is important to realize that trenching deaths are almost totally preventable with

reasonable care and proper equipment. As an initial step to address the problem of trenching deaths and to prevent the conditions that produce them, OSHA published a revised standard covering excavations in the Federal Register on October 31, 1989. The effective date of the standard was April 1, 1990.

The standard defines excavations, including trenches; sets out general requirements for the protection of employees in excavations; and describes requirements for protective systems (see Standard in Brief, below).

The primary purpose of the revisions is to clarify the requirements so that firms can tailor their protective measures to their particular situations while still providing adequate employee protection.

The revised standard uses performance criteria where possible, rather than specification requirements, and it provides a consistent method of soil classification. Soil classification is necessary because virtually all protective systems are based on soil type and other environmental conditions at the site.

The revised standard allows construction projects more flexibility since it provides four options for sloping and four options for shoring (including using trench shields).

In April 1990, OSHA launched an extensive outreach program on the standard. Working with trade associations, professional groups, and labor organizations, the agency held education sessions around the country to familiarize the construction industry with the guidelines and intent of the document. More than 12,000 industry representatives participated.

In the two years since it came into effect, OSHA has vigorously enforced the excavation standard. For the period



This failed excavation in Washington, D.C. is the subject of a major OSHA report on unsafe shoring practices.

April 1990 to February 1992, OSHA cited construction organizations with more than 10,000 violations of the standard. Eighty percent of these violations were classified as serious, five percent were considered willful, five percent were repeat violations, and ten percent were other classifications.

During this same time period, OSHA also investigated 49 excavation construction accidents involving fatalities.

The sections of the standard that are most frequently cited in this period were:

- protection of employees in excavations — 29CFR1926.652(a)(1)
- inspections — 29CFR1926.651(k)(1)
- access and egress/structural ramps — 29CFR1926.651(c)(1)
- protection of employees from loose rock or soil — 29CFR1926.651(j)(2)

Citations most often result in a fine against the contractor for practices that could endanger workers' safety on the job site. In some cases, criminal prosecutions have been pursued for violations of the standard. In one case in Kansas, involving a worker killed in a trench collapse, a businessman pleaded guilty to one criminal charge of willful failure to comply with the standard. He was fined \$7,500 and given probation and a four-month suspended jail sentence. He was also required to develop and promote an excavation safety program working with the Kansas Contractors Association.

Because trench safety is an ongoing concern, OSHA staff members are available to address the technical issues associated with excavations. The staff includes engineers in OSHA field offices around the country, members of the Directorate of Safety Standards in the national office, and professional engineers

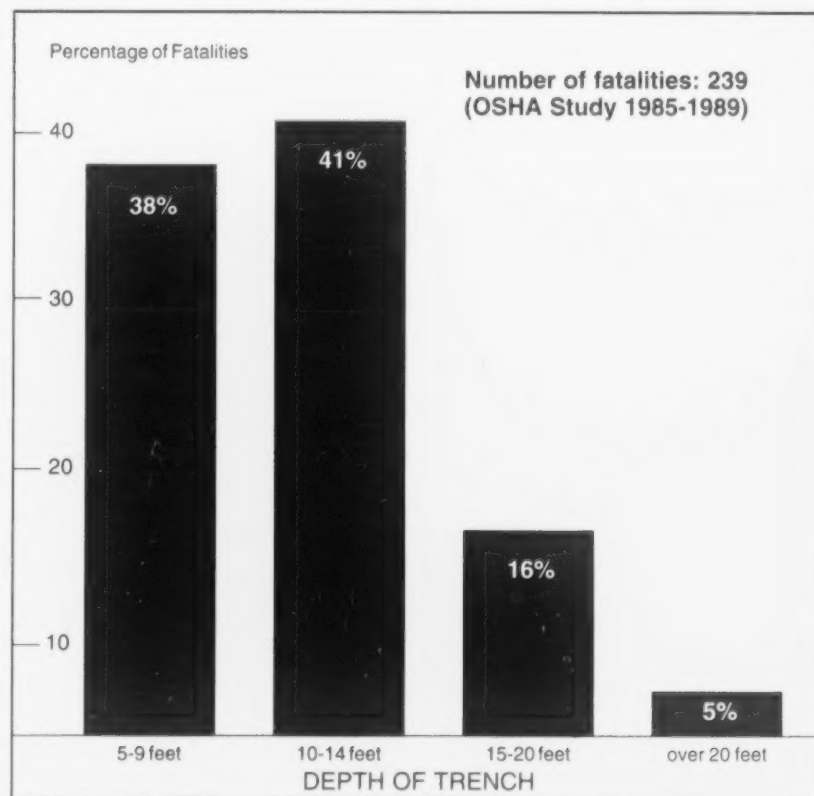


Figure 1: Analysis of trenching fatalities.

with geotechnical expertise in the Office of Construction and Engineering (OCE), also located in the national office.

The OCE staff provides assistance to the field in responding to complex technical issues that arise. The office also investigates major construction accidents to determine their causes. In May 1991, for example, the office published a report on the investigation of a major excavation failure that occurred in Washington D.C. in November of 1990. Results from these investigations are published and distributed to the construction industry in

an effort to improve safety and prevent recurrence.

The office is also working with construction industry groups to address technical issues. For example, they are cooperating with the National Utility Contractors Association (NUCA) and OSHA field staff on design requirements for trench boxes.

In the future, OSHA will continue to enforce the excavation standards to ensure a safer workplace, and we will also work with construction groups to discover ways to improve excavation safety.

SOURCES OF HELP

- For self-help, refer to OSHA General Industry Standards (CFR parts 1900-1910) and OSHA construction Standards (CFR Part 1926). Together these sections include all OSHA job safety and health rules and regulations covering construction. (OSHA publication 29 CFR 1926/1910, OSHA 2207, Revised 1991.)

- For information on OSHA-funded free consultation services call the nearest OSHA area office. It is listed in telephone directories under "U.S. Labor Department" or under the state government section in those states where the

state administers its own OSHA programs.

- The OSHA Safety and Health Training Guidelines for Construction are a set of 15 guidelines to help construction employers establish training programs in the safe use of equipment, tools, and machinery on the job. The guidelines are available as Order No. PB-239-312/AS from:

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On the cover:

This equipment operator for Mannesmann is bundled up against the spring cold as he helps lower pipe into the new German STEGAL system. See story page 30. (photograph by Mannesmannrohren-Werke AG)

International Pipeline Forecast

Healthy Growth Predicted In 1993 For International Market

By Oliver Klinger Jr.

International pipeline construction has entered a fast-growing period, accelerated by the new democracies in eastern Europe and by increasing demands for oil, gas and petroleum products in many parts of the world. Europe, the Middle East and Far East have many projects that will be constructed in the next few years.

Pipeline & Utilities Construction's projection is for 32,341 miles of new gas, products and crude oil pipelines in the 1992-93 period to cost in excess of \$30 billion. Natural gas lines will comprise most of the pipeline expansion work, with 22,855 miles scheduled at a cost of roughly \$26.3 billion. Products pipelines planned total 5,847 miles to cost \$2,788,000, while a conservative estimate for crude oil lines projects 1,859 miles to cost \$995 million.

Future pipelines, which may develop in the mid or late 90s, now total 13,781 miles to cost an estimated \$10,940,000. These figures appear certain to expand substantially in coming years.

Among major gas pipelines to be constructed are the SNAMENEL Trans-Med line expansion from Algeria to Italy to cost several billion dollars and Statoil's Zeepipe system of 681 miles from the North Sea to landfall in Germany, costing \$750 million. Germany's Midal line runs 398 miles at a cost of \$583 million and Ruhrgas and other German gas companies have substantial expansion programs.

South America will see a boom in gas line construction with many new major lines to be constructed in Argentina, Bolivia, Brazil and Colombia.

Asia and China will see substantial activity with the Petronas

Phase III Peninsular Gas Project underway. China has major lines planned from the Yacheng field to Hong Kong and Hainan. Thailand and Indonesia's Pertamina have substantial pipeline work scheduled.

Iran has a major program for new oil and gas lines while Kuwait is rebuilding its entire pipeline network. Spain and Portugal have major projects as does Greece and Thailand.

The North Sea has some new major pipelines planned as has Australia, South Korea and Japan. The former Soviet Republics need and plan many new gas pipelines which will be constructed if and when financing becomes available.

There will also be substantial new gas distribution lines and grids constructed in many parts of the world but those figures are not included in these projections.

INTERNATIONAL PIPELINE FORECAST 1992-93

	Mileage	Est. Cost In Billions
Natural Gas Pipelines	22,835	26.295
Petroleum Product Pipelines	5,847	2.788
Crude Oil Pipelines	1,859	.995
TOTALS	32,341	30.068
FUTURE PIPELINES		
Total Mileage All Pipelines	13,781	10.940

Natural Gas Transmission

Abu Dhabi National Oil Co.

Abu Dhabi
93 miles, 28 inches
Magta to Al Ain
Cost: \$50 million

Sonatrach - Algeria
328 miles, 48 inches
Hassi R Mel field to Moroccan border
Cost: \$250 million

Gas del Estado - Argentina
350 miles, 18 inches
Santa Fe, Argentina to Montevideo, Uruguay
774 miles, 30 inches
Salta Province, Argentina to Rio Grande do Sul, Brazil
Cost: \$300 million

Mt. Isa Mines Ltd. - Australia
500 miles, medium diameter
Cooper Basin fields to Mt. Isa
Cost: \$75 million

Gas & Fuel Corp. of Victoria
Australia
80 miles, various sizes
Katnook to Portland, Victoria

Cost: \$20 million
209 miles, various sizes
Melbourne, Victoria
Cost: \$16 million

Magellan Petroleum Corp.
Australia
375 miles
Amadeus-Darwin tie line to Gove
Cost: \$150 million

Petrobangla - Bangladesh
159 miles, six, 16, 20 inches
Kailashtila field to grid in Ashuganj
Cost: \$48.8 million

Distrigaz - Belgium
91 miles, 40 inches
Zeebrugge to Biaregnies
60 miles, 20 inches
Berneau to Bastogne
16 miles, 10, 16, 24 inches
Est. cost: \$150 million

YPFB - Bolivia
332 miles, 24 inches
Santa Cruz to Brazilian border
Cost: \$250 million

Companhia do Gas - Brazil
700 miles

Renewal of Sao Paolo gas line grid
serving 212,000 homes and 900
industries
Est. cost: \$75 million

Petrobras
Brazil
744 miles, 20-24 inches
Sao Borjato, Porto Alegre to Rio Grande do Sul
Cost: \$300 million
Second phase cost: \$400 million
1,175 miles, large diameter
1,050 miles from Urucu region to Carajas, 125-mile spur to Manaus
Extensions to Belem and Sao Luis
could add 700 miles
Cost: \$400 million

Arco China/China National Offshore Oil Co. - China
480 miles, 30 inches
Yacheng field to Hong Kong
60 miles, 16 inches
Yacheng field to Hainan Island

Carbocol - Colombia
310 miles, 24 inches
San Cristobal, Venezuela to Bogota, Colombia
Cost: \$200 million

Ecopetrol - Colombia
58 miles, 20 inches
Dibulla to Ballenas
Cost: \$30 million

Promigas - Colombia
621 miles, 20-24 inches
373 miles, 20 inches
248 miles, 24 inches
Dibulla to Ballenas
Cost: \$250 million

Naturgas Miat-Nord - Denmark
Gas grid system in Jutland provinces
Cost: \$42 million
Dubai Natural Gas Co.
Dubai
200 miles, large diameter
Qatar's North field to Jebel Ali, Dubai
Cost: \$150 million

Bapetco
Egypt
74 miles, 16 inches
55 miles, 16-inch loop
BED-2 to Aminiriyah
19 miles
BED-2 to BED-3
Cost: \$60 million

Gaz de France - France
44 miles, medium diameter
Salam to Lacq
Cost: \$30 million

EVG - Germany
100 miles, medium diameter
Achim to Salzwedel
Cost: \$50 million

Erdgasversorgungsgesellschaft
Germany
200 miles
Vitzroda to Niederhohndorf, Saxony
Cost: \$150 million

Kombinat Gasanagen - Germany
155 miles, medium diameter
Philippsthal to Sayda

Midal Gas Line - Germany
Joint venture: Wintershall OMV
398 miles, 32 inches
Emden to Ludwigshafen

Ruhrgas AG - Germany
153 miles, 48 inches
Werne to Schluchtern
49 miles, 40 inches
Lauterbach to Vitzroda
15.5 miles, 24 inches
Vinnhorst to Ahlten
Cost: \$150 million

Athens Gas Department - Greece
316 miles, 30 inches
Bulgarian border to Athens
Cost: \$250 million

State Oil and Gas Trust - Hungary
200 miles, 28-32 inches
Beegdoroc to Szeged
Cost: \$125 million

Gas Authority of India, Ltd. - India
900 miles, large diameter
Bombay to Bangalore
7,500 miles, large diameter
National gas grid
Cost: \$3 billion

Gujarat Gas Co. Ltd. - India
330 miles, medium diameter
Gas network in Gujarat state
Cost: \$150 million

Oil and Gas Commission - India
175 miles, medium diameter
East and West Godavan districts of
Andhra Pradesh
Cost: \$150 million
95 miles, medium diameter
Southern loop, Western Offshore
Integrated Development Project
Cost: \$75 million

Pertamina - Indonesia
280 miles
Offshore line Kangean field in Bali to
Surabaya and Gresik in East Java
Cost: \$200 million

Bord Gais - Ireland
170 miles, 24 inches
Scotland to Eire
Est. cost: \$243 million

Snam and Enel
Italy
683 miles, 48 inches
Trans-Med expansion
229 miles, 48 inches
Loop line to Cape Bon
Est. cost: \$7.3 billion

Agip - Libya
350 miles, large diameter
Bourin field offshore of Libya to Italy
Cost: \$3 billion

Libyan government - Libya
448 miles, 30 inches
400 miles, al Brika to Khoma
48 miles, Sirte Basin
Cost: \$880 million

Ministry of Energy - New Zealand
140 miles, 14-20 inches
Huntly to Marsden power stations
Cost: \$70 million

Midgard Field Partners - Norway
300 miles, large diameter
Midgard field to existing Norwegian
gas grid
Cost: \$300 million

Norske Shell - Norway
Troll field to processing plant at
Oeygarden or Bergen
Cost: \$50 million

Statoil - Norway
681 miles
North Sea to Germany
96 miles
German land line (Zeepipe project)
Est. cost: \$750 million

Petroleum Development Co. - Oman
68 miles, medium diameter
Lekhwair field to domestic gas grid
Cost: \$30 million
Pakistan
Phase III Peninsular Gas Utilization
Project
320 miles, 24 inches
Five-state area
Cost: \$250 million

Portuguese government - Portugal
Maqta to Al Ain
200 miles
Lisbon to Braga near Spanish border
plus distribution systems - five-year
program
Cost: \$300 million

Korea Gas Corp. - South Korea
825 miles, large diameter
Network connecting 20 major cities
Cost: \$2.2 billion

Engas - Spain
300 miles, 26 inches
Seville to Madrid
Cost: \$2 billion
200 miles, 12-24 inches
Redes Navarra area
Cost: \$60 million

Stoseb - Sweden
150 miles gas grid around Stockholm
Cost: \$30 million

Al-Furat Petroleum - Syria
335 miles, eight-18 inches
275 miles, 18 inches
Omar field to Damascus
60 miles, eight-12 inches
Omar field to Thayyem, Thireen, Adra
Cost: \$150 million

Petroleum Authority
Thailand
106 miles, 30, 32 inches
Erawan offshore field to onshore
terminal at Surai Thani
208 miles, 24 inches

Erawan field to shore terminal
Est. cost: \$200 million

Tunisia
149 miles
Construction of gas line from
M'Saken to Gabes and construction
of gas grid
Est. cost: \$75 million

Botas - Turkey
400 miles up to 12 inches
Bursa city distribution system
510 miles, large diameter
310 miles from Bursa to Izmir and
210 miles from Izmir Karabuk
Cost: \$225 million

Amoco Exploration Co.
United Kingdom
254 miles, 36 inches
Central Area Transmission system
Everest and Lomon offshore field to
Teesside
Cost: \$225 million

Kinetica Ltd. (Conoco PowerGen)
United Kingdom
180 miles, 30-36 inches
Lincolnshire coast to power stations
Cost: \$30 million

**Scottish Area Gas Evacuation
System (SAGE)** - United Kingdom
150 miles, 24 inches
Mobil North Sea Marathon Oil, Beryl
North Sea field to St. Fergus
Cost: \$75 million

**Shell U.K. Exploration and
Production** - United Kingdom
118 miles, 24 inches
Bacton to Shell Haven refinery on
the Thames Estuary
Cost: \$75 million

Total Oil Marine - United Kingdom
110 miles, 22 inches
Caister field, U.K. North Sea, to
Killingholme
Cost: \$75 million

Corpoven - Venezuela
115 miles loop line
Anaco to Puerto la Cruz
209 miles
Anaco to Porto Ordaz
Est. cost: \$100 million
Foreign Gas Distribution

Gas & Fuel Corp. of Victoria
Australia
Distribution
145 miles, various inches
Various locations in Victoria
Cost: \$15 million

**Ver. Energiebedrijven
Scheldeland (EBES)** - Belgium
132 miles, various inches
Cost: \$11 million

Pertamina
Indonesia
270 miles, various inches
Offshore Kangea to Bali, Surabaya
and Gresik
Cost: \$120 million

Korea Gas Co
South Korea
857 miles, various inches
Various locations in South Korea
Cost: \$200 million

Crude Oil Lines

Broome Oil Pipeline Systems
Australia
300 miles, medium diameter
Canning basin area of Western
Australia
Cost: \$85 million

Conoc
Commonwealth of Independent
States
400 miles
Tengiz field in Siberia to Caspian
Sea
Est. cost: \$200 million

Maxus Energy Co. (Dallas)
Ecuador
120 miles
Lago Agrio to Shushufindi,
Ecuador
80 miles diesel line to supply
turbine generators
Cost: \$40 million

Chemopetrol Pipeline Ltd.
Germany
210 miles, 20 inches
Ingolstadt, Germany to Kralupy
and Vlaton, Czechoslovakia
Cost: \$50 million

National Iranian Oil Co. - Iran
600 miles, large diameter
Gach Sarn field near Persian Gulf
to Port of Jask, Gulf of Oman
Cost: \$500 million

New Guinea government
New Guinea
106 miles, 20 inches
Kutibo and Hedina oil fields to
marine terminal at Cape
Blackwood
Est. cost: \$60 million

**Shell Pipeline Petroleum
Development** - Nigeria
43 miles, 20-24 inches
Opukushi to Forcados terminal
Cost: \$50 million

Product Pipelines

Petrobras - Brazil
252 miles, eight, 10 inches
Temadre to Itazuna
162 miles, eight, 10 inches
Reporto to Florianopolis
578 miles, 12-20 inches
Replan to Brasilia
Cost: \$400 million

SPMR - France
93 miles, 42 inches
La Mede to Buget
Est. cost: \$100 million

National Iranian Oil Co. - Iran
1,139 miles, 12 inches
Arak to Malayer and Mamadan
Est. cost: \$400 million

Indian Oil Corp. - India
800 miles, 22 inches
Kandla to Karmal
132 miles, 14 inches
Karmal to Bhatinda
72 miles, 10, 14 inches
Bhatinda to Kot Jodhpur
Est. cost: \$250 million

Laos government Laos
260 miles, medium diameter
Vinh Vietnam to Vientiane, Laos
Cost: \$85 million

Nigerian National Petroleum Co.
Nigeria
1,200 miles
Port Harcourt to Benin, Auchi to
Kaduna
Cost: \$583 million

Statoil
Norway
140 miles, 20 inches
Condensate line from Sleipner field to
Karstoe
Cost: \$420 million

Bela Group
Switzerland
180 miles
Wilhelmshaven refinery to Dresden,
Germany
Est. cost: 280 million

Thai Petroleum Pipeline Co.
Thailand
145 miles, main and lateral lines
Sriracha refineries to north and east
Bangkok terminals
Est. cost: \$200 million

British Petroleum
United Kingdom
150 miles, 24 inches
Bruce field to Forties field, U.K. North
Sea
Cost: \$100 million

Future projects

Maghreb-Europe Gas Line
Algeria, Spain
Joint venture between Sonatrach
(Algeria) and Engas (Spain)
760 miles of gas line to supply Spain
and Europe
Est. cost: \$1.5 billion
Completion: 1995

**Department of Resources and
Energy - Australia**
3,000 miles, large diameter gas line
Transcontinental Australia gas system
Est. cost: \$3 billion

TransAsian Consortium
Brunei, Indonesia, Malaysia, Philippines,
Thailand
5,000 miles, large diameter
Fields offshore Thailand through
Malaysia, Indonesia and Brunei to the
Philippines
Cost: \$3 billion

Gasnatural - Chile
Shell Chile and local gas distributors
plan gas line from Argentina
Est. cost: \$1.375 billion

Colombian government - Colombia
Plans nationwide gas grid to be fed by
pipeline from Venezuela
Est. cost: \$1.375 billion

**Commonwealth of Independent
States**
Commonwealth of Independent States
1,075 miles, large diameter
375 miles from Stokmanovskoye field
in Barents Sea to Murmansk

650 miles from Murmansk to St.
Petersburg
Cost: \$3 billion

Egypt General Petroleum Corp.
Egypt
Trans-Gulf gas line from October and
Belayan fields to Ras Shukair
Est. cost: \$75 million

Petroleum Exploration Co. (Japex)
Japan
150 miles from two western Japanese
fields to Tokoku Electric Co. on Pacific
Coast
Est. cost: \$50 million

Trans Mexico - Mexico

1,315 miles, 30 inches
Line following Mexico-U.S. border
Cost: \$1 billion

Petroleos del Peru
Peru
364 miles, 26 inches
64 miles, eight inches
Gas lines to Camisea to Cuzco to
Callao-Lima
52 miles
Gas and product line from Aguaytia to
Pucallpa-Campo Verde
Est. cost: \$250 million

General Petroleum Corp. - Qatar
994 miles
Gas line from Qatar to United Arab

Emirates and Iran
Est. cost: \$3 billion

Trinidad and Tobago
Trinidad and Tobago
800 miles, large diameter
Trinidad and Tobago to Puerto Rico
and other Caribbean islands
Cost: \$2.5 billion

Yugoslavian government
Yugoslavia
650 miles, small to medium
diameter
160 miles main line
415 miles main and distribution lines
75 miles urban mains
Cost: \$100 million



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